

MOTEGGIA FRACTURE AND DISLOC



Presented By:
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Moderator: Prof. H.L. Nag
Co-moderator: Dr. Vaibhav

I will be discussing the topic under the following heads:-

1. Definition
2. History
3. Epidemiology
4. Classification
5. Mechanism of Injury
6. Clinical features and management.
7. Complications
8. Old neglected Monteggia fracture dislocation.
9. Recent updates

WHAT IS MONTEGGIA FRACTURE DISLOCATION

Historically described as :

***“fracture proximal third of shaft of ulna with
dislocation of radial head”***



HISTORY

In 1814 *Giovanni Batista Monteggia*, a surgical pathologist and public health official in Milan, first described Monteggia fractures. He observed the original two injuries in cadavers and provided the description:

“Traumatic lesion distinguished by a **fracture of the proximal third of the ulna and an anterior dislocation of the proximal epiphysis of the radius.**”

EPIDEMIOLOGY

Monteggia fractures constitute about 1 to 2% of forearm fractures.

Of the Monteggia fractures, Bado type I is the most common (59%), followed by type III (26%), type II (5%), and type IV (1%).



CLASSIFICATION

- ✓ ***Bado's classification*** * Jose Louis Bado in 1958 divided Monteggia fractures into four types of true Monteggia lesions.

- ✓ Bado also classified certain injuries as ***equivalents*** to the classic or true Monteggia lesions because of their similar mechanism of injuries, radiographic pattern, or methods of treatment.

* Bado JL. The Monteggia lesion. Clin Orthop 1967;50: 71 to 86.

✓ Type I : Anterior dislocation: The radial head is dislocated anteriorly and the ulna has a fracture in the diaphyseal or proximal metaphyseal area.

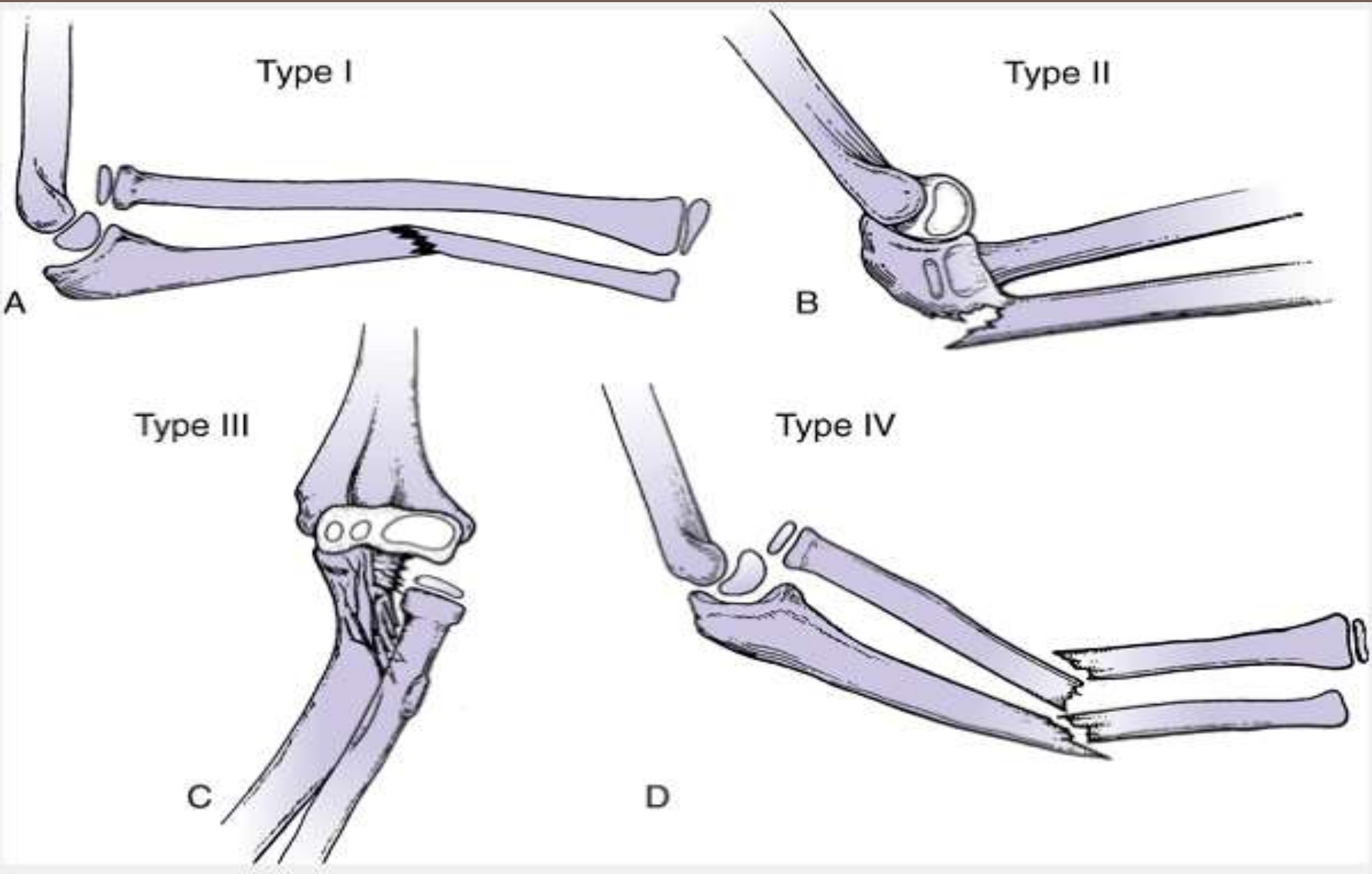
✓ Type II : Posterior dislocation: The radial head is posterior/posterolaterally dislocated, the ulna is usually fractured in the metaphysis.



✓Type III: Lateral dislocation : There is lateral dislocation of the radial head with a metaphyseal fracture of the ulna.

✓Type IV : Anterior dislocation with radius shaft fracture : the pattern of injury is the same as with a type I injury, with the inclusion of a radius shaft fracture below the level of the ulnar fracture.

BADO'S CLASSIFICATION



TYPE I EQUIVALE



1. Isolated anterior radial head dislocation
2. Ulnar fracture with fracture of the radial neck.
3. Isolated radial neck fractures.
4. Fracture of the ulnar diaphysis with olecranon fracture and posterior dislocation of the ulnohumeral joint with or without fracture of the proximal radius.

TYPE II EQUIVALENTS

- ❖ In his original classification, Bado stated that there were no equivalents to type II Monteggia lesions other than epiphyseal fracture of the radial head or fracture of the radial neck.
- ❖ Considering the mechanism of this injury as defined by Penrose , a **posterior elbow dislocation** could be considered a type II equivalent in children.

OTHER

CLASSIFICATIONS

❖ **Letts et al*** devised a classification of Monteggia fractures in children based on both the direction of the radial head dislocation and the type of ulnar fracture.

❖ The Bado type I class was subdivided into three sub types.

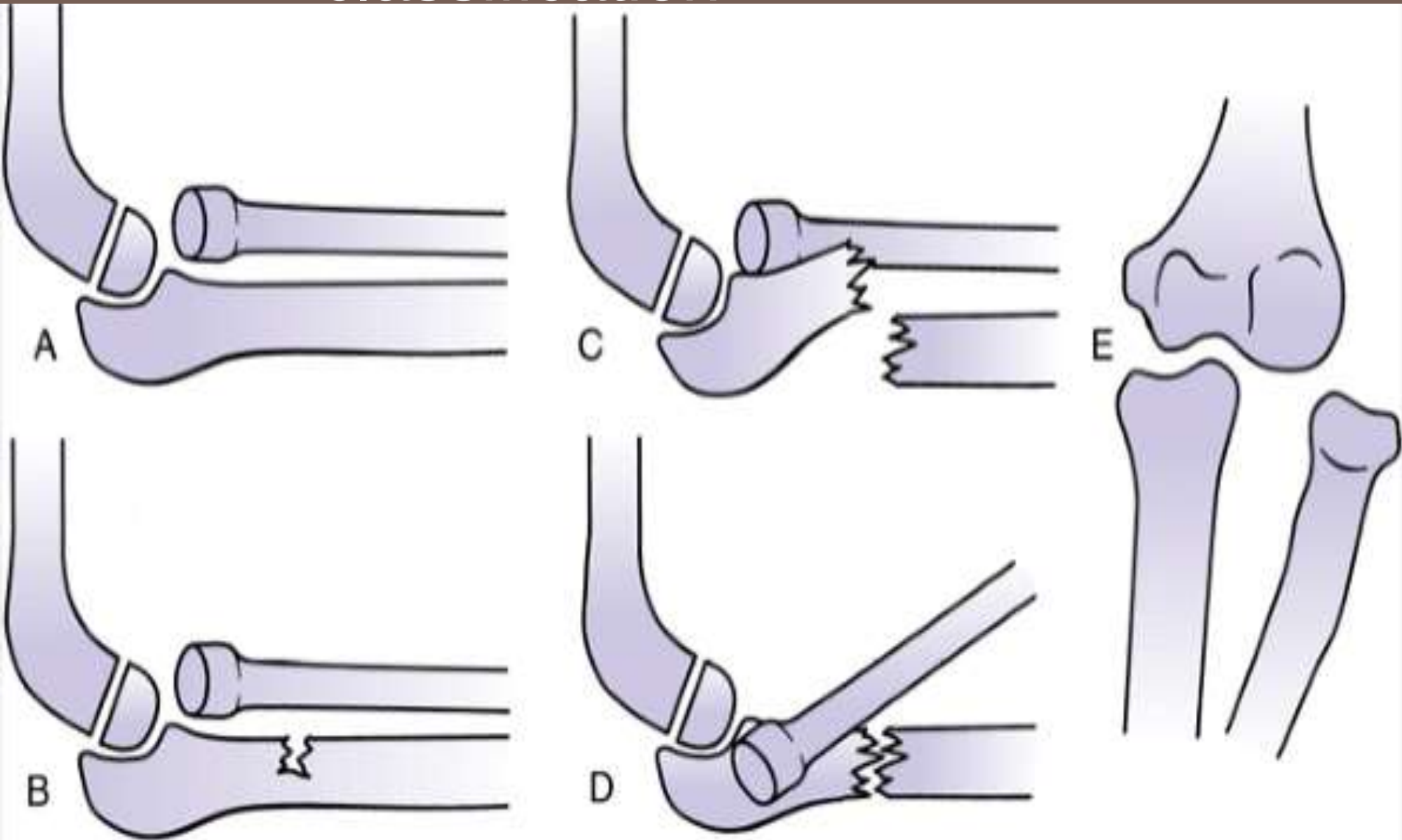
Type A is anterior bowing of the ulna due to **plastic deformation** with anterior dislocation of the radial head.

Type B includes a greenstick fracture of the ulna, and

type C has a complete ulnar Fracture.

* Letts M, Loch R, Wiens J. Monteggia fracture dislocations in children. J Bone Joint Surg [Br] 1985;67:724 - 727.

Letts et al classification



***Dormans and Rang* *: In 1990**

Extended Bado's classification by adding a type V, intermittent and habitual dislocation of the radiocapitellar joint and proximal radioulnar joint.

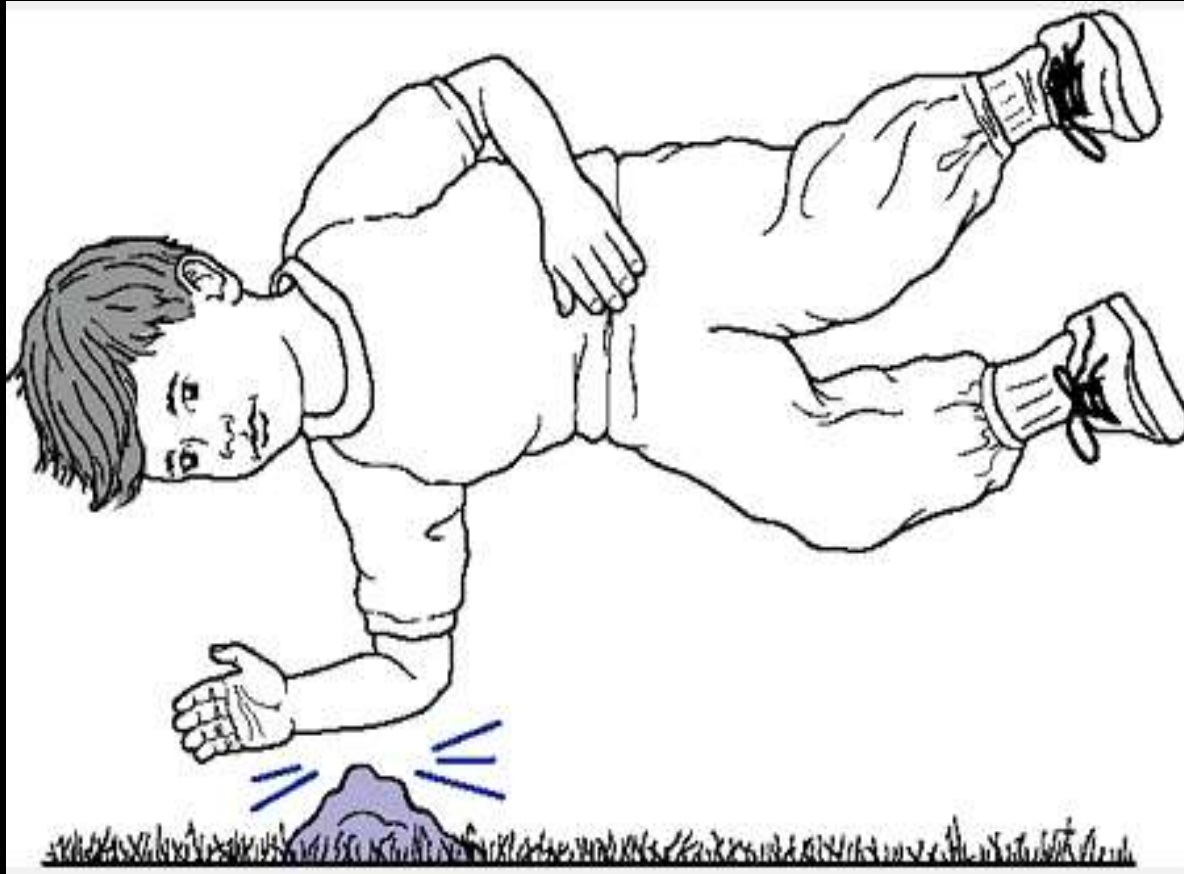
*Dormans JP, Rang M. The problem of Monteggia fracture dislocations in children. Orthop Clin North Am 1990;21:251.

MECHANISM OF INJURY FOR TYPE I LESION

1) **Direct Blow Theory :**

Described by *Speed and Boyd* and confirmed by *Smith*

“Fracture occurs when a direct blow on the posterior aspect of the forearm first produces a fracture through the ulna. Then, either by continued deformation or direct pressure, the radial head is forced anteriorly with respect to the capitellum, causing the radial head to dislocate.”

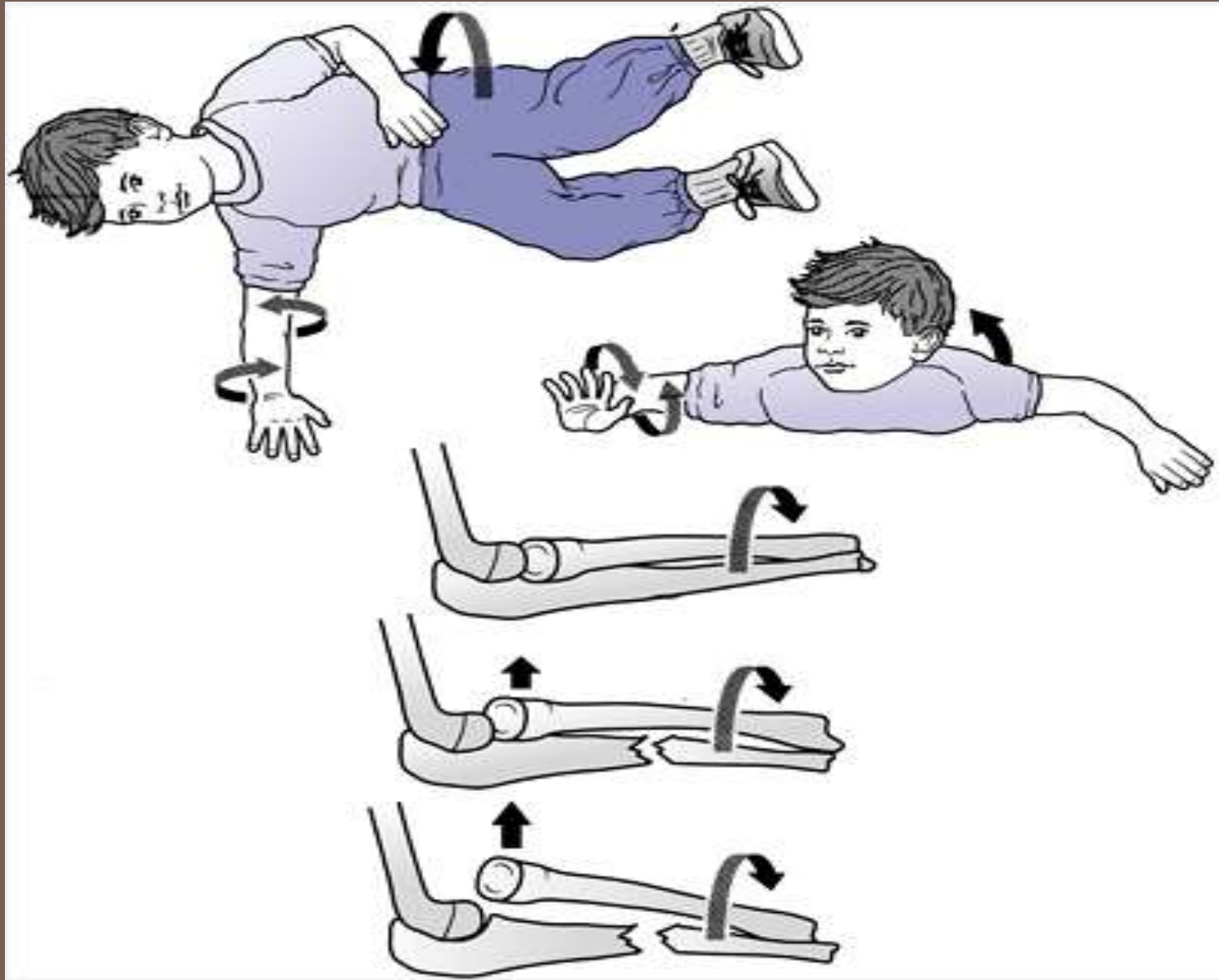


The fracture dislocation is sustained by direct contact on the posterior aspect of the forearm, either by falling onto an object or by the object striking the forearm. The continued motion of the object forward dislocates the radial head after fracturing the ulna

2. HYPERPRONATION THEORY :

In 1949 *Evans* postulated that during a fall, the outstretched hand, initially in pronation, is forced into further pronation as the body twists above the planted hand and forearm .

This hyperpronation causes the radius to be crossed over the mid-ulna, resulting in anterior dislocation of the radial head or fracture of the proximal third of the radius and fracture of the ulna.

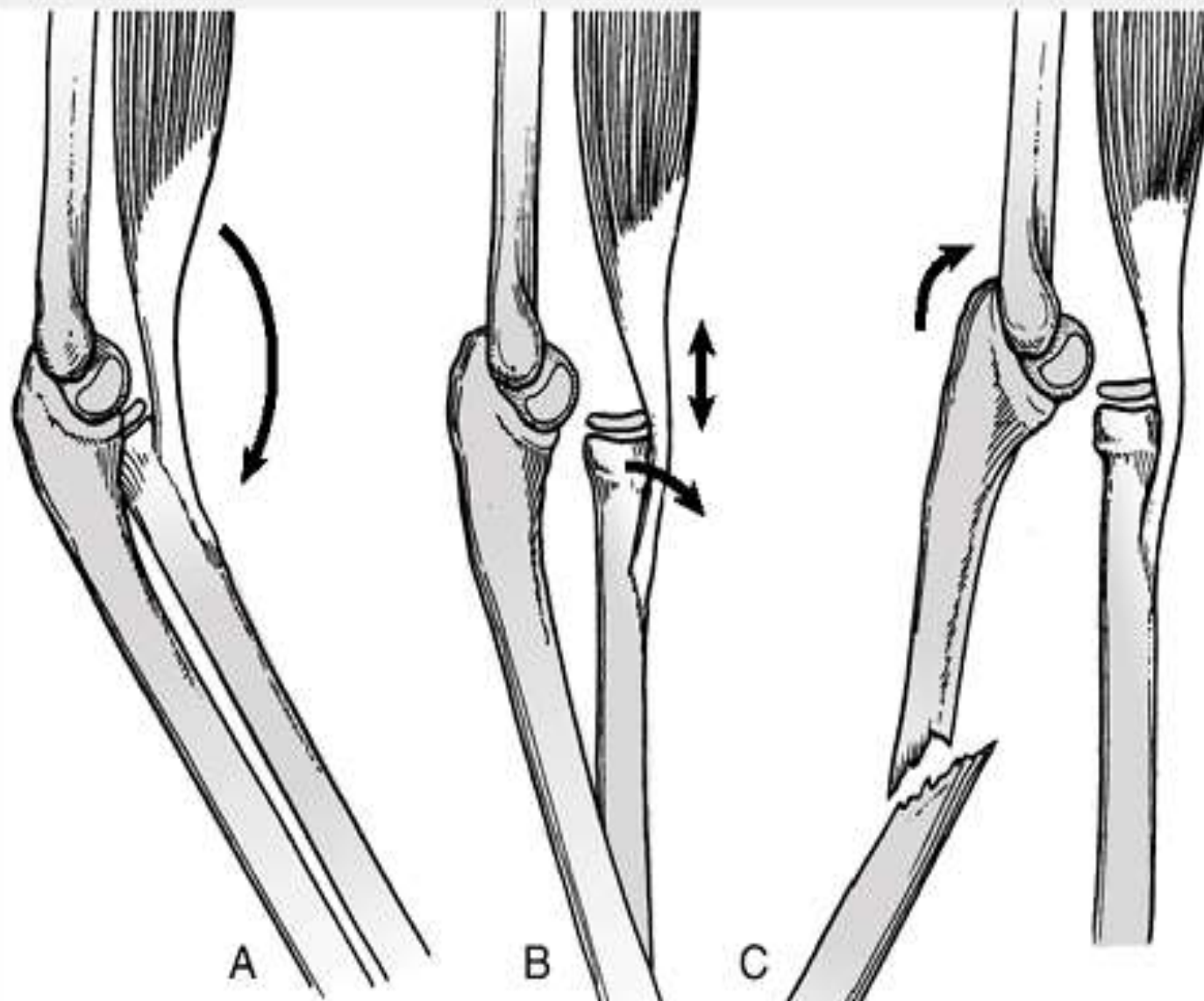


3. HYPEREXTENSION THEORY

Presented by *Tompkins* in 1971.

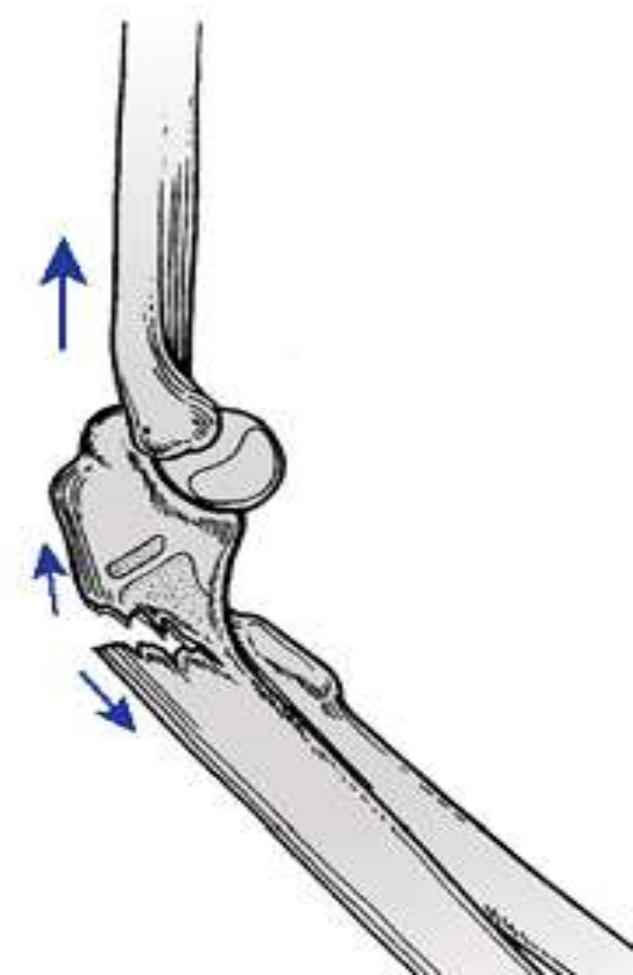
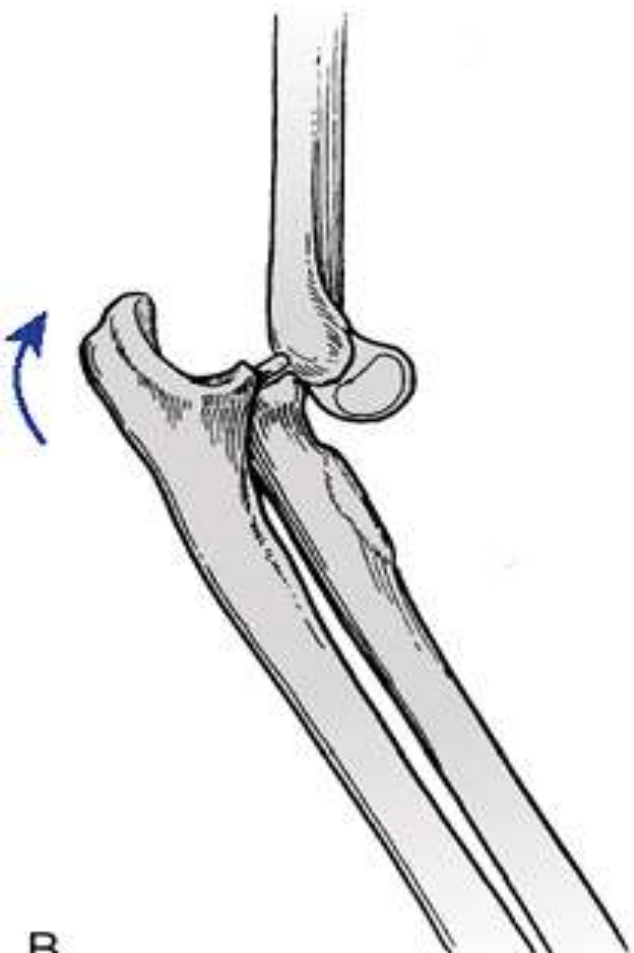
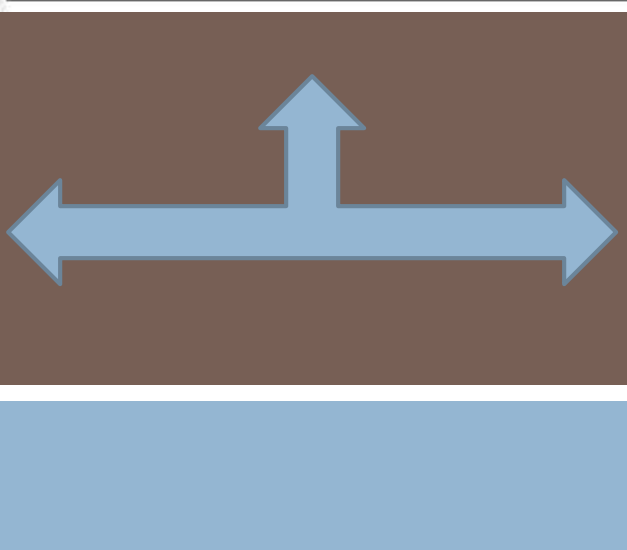
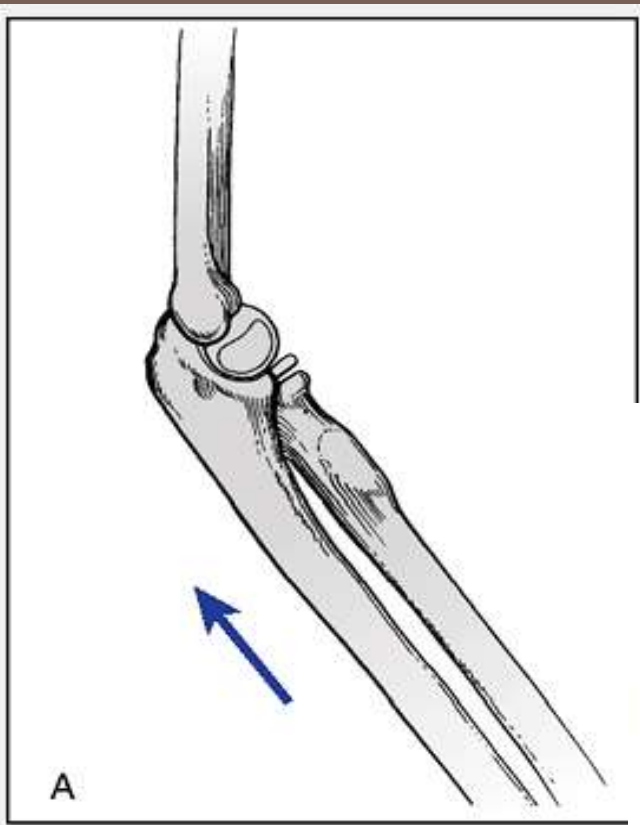
Combination of dynamic and static forces.

- 1). Hyperextension: forward momentum caused by a fall on an outstretched hand forces the elbow into extension.
- 2). Radial head dislocation: the biceps contracts, forcibly dislocating the radial head.
- 3). Ulnar fracture: forward momentum causes the ulna to fracture because of tension on the anterior surface.



MECHANISM OF INJURY TYPE II LESION

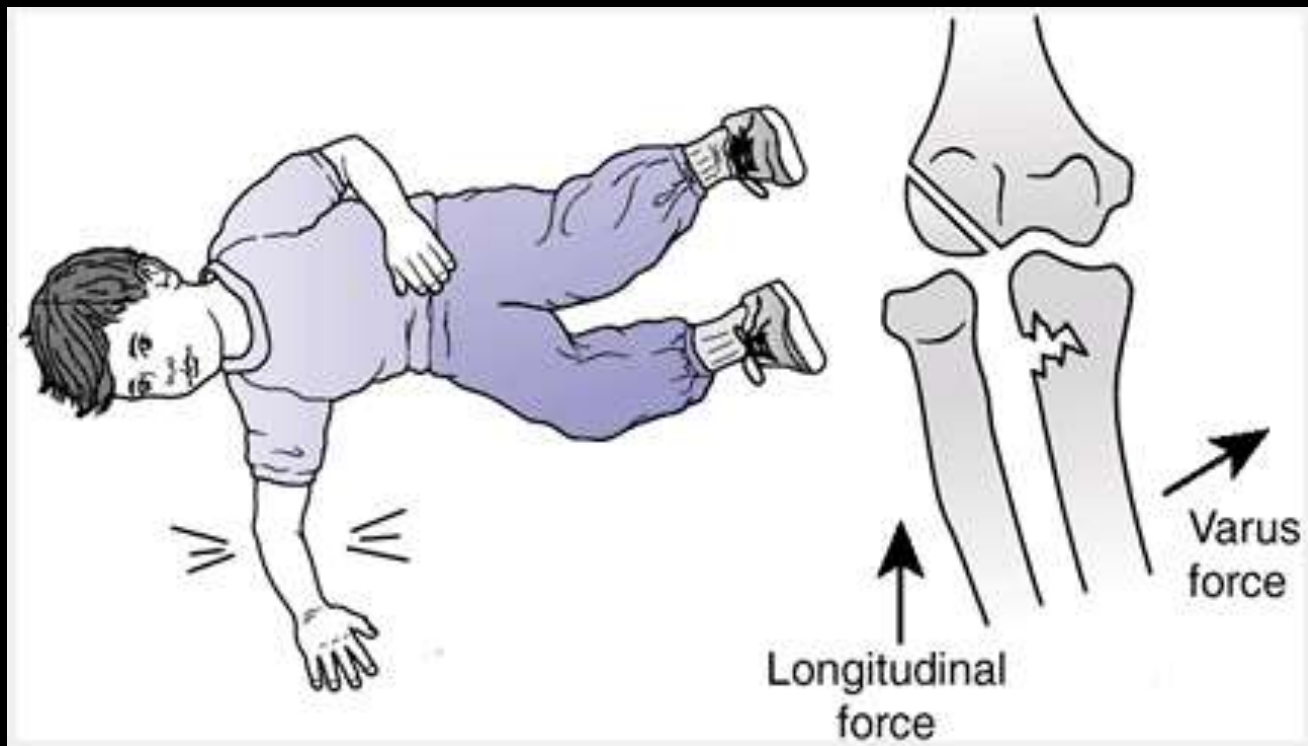
- ❖ The mechanism proposed and experimentally demonstrated by Penrose was that type II lesions occur when the forearm is suddenly loaded in a longitudinal direction with the elbow flexed 60 degrees.
- ❖ He showed that a type II lesion occurred consistently if the anterior cortex of the ulna was weakened; otherwise, a posterior elbow dislocation was produced.



B

MECHANISM OF INJURY FOR TYPE III LESION.

- ❖ Varus stress at the level of the elbow, in an outstretched hand planted firmly against a fixed surface.
- ❖ This usually produces a greenstick ulnar fracture with tension failure radially and compression medially. The radial head dislocates laterally, rupturing the annular ligament.



TYPE I LESION

Most common type: approx. 59%
In most series.

Clinical Findings:

- ❖ Fusiform swelling about the elbow.
- ❖ Painful restriction of movements i.e. elbow flexion , extension, pronation and supination.
- ❖ An angular deformity of forearm with the apex shifted anteriorly.
- ❖ Child may not be able to extend the digits at the metacarpophalangeal joint or at the interphalangeal joints because of a paresis of the posterior interosseous nerve.



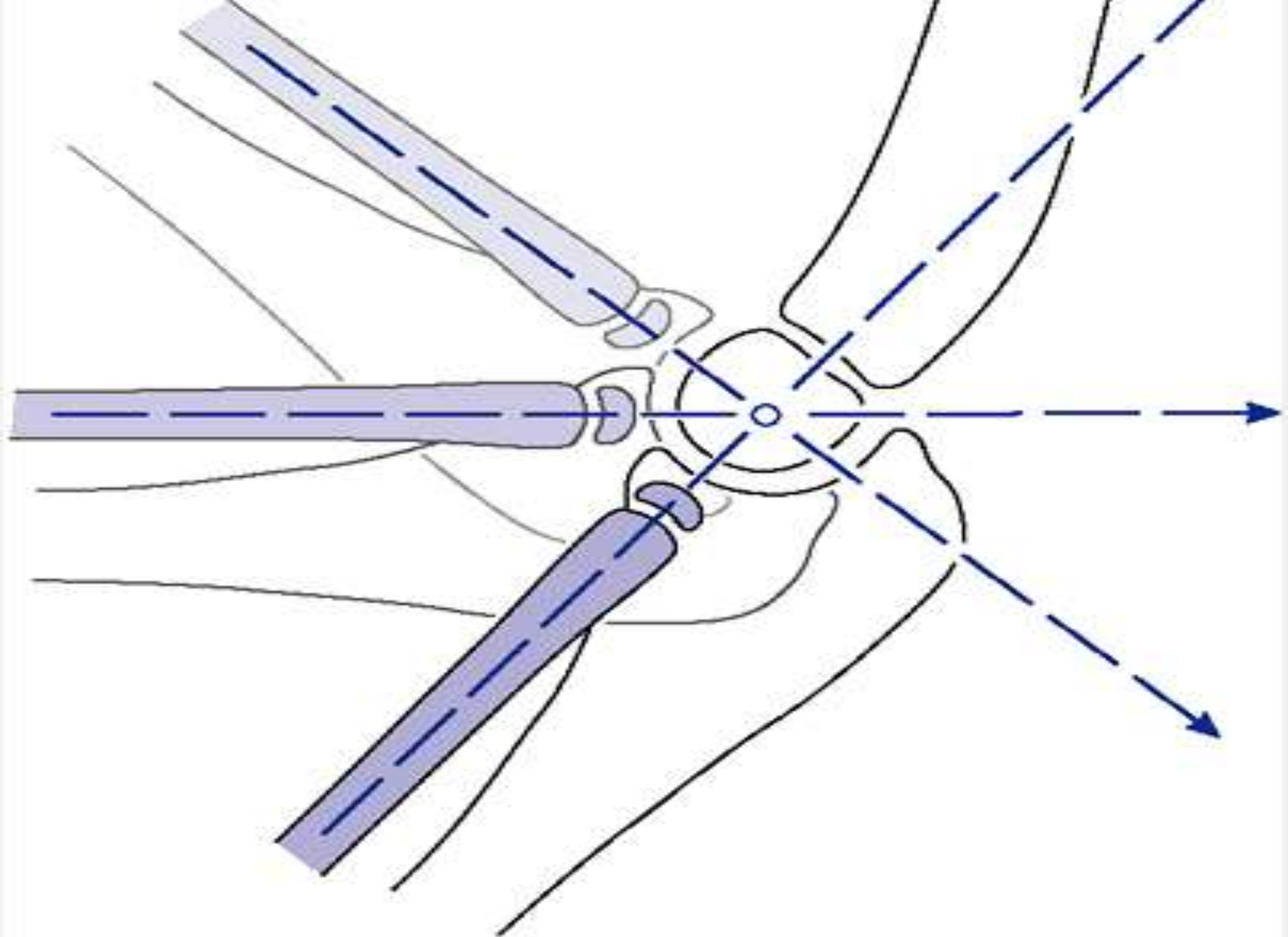
RADIOGRAPHIC EVALUATION

- ❖ Anteroposterior (AP) and Lateral x-rays of the forearm.
- ❖ Radiographs of the joints at either end of the forearm, particularly the position of the radial head

Radiocapitellar Relation:

Best defined by a true lateral view of the elbow.

A line drawn down the long axis of the radius bisects the capitellum of the humerus regardless of the degree of flexion or extension of the elbow.



MANAGEMENT

NON OPERATIVE

1).Reduction of the Ulnar Fracture:

To reestablish the length of the ulna by longitudinal traction and manual correction of any angular deformities present.

Up to 10 degrees of angulation is acceptable in a complete. fracture, providing a concentric radial head reduction is maintained.



2).Reduction of the Radial Head:

by flexing the elbow to 90 degrees or more

Flexion of the elbow to 110 to 120 degrees stabilizes the reduction

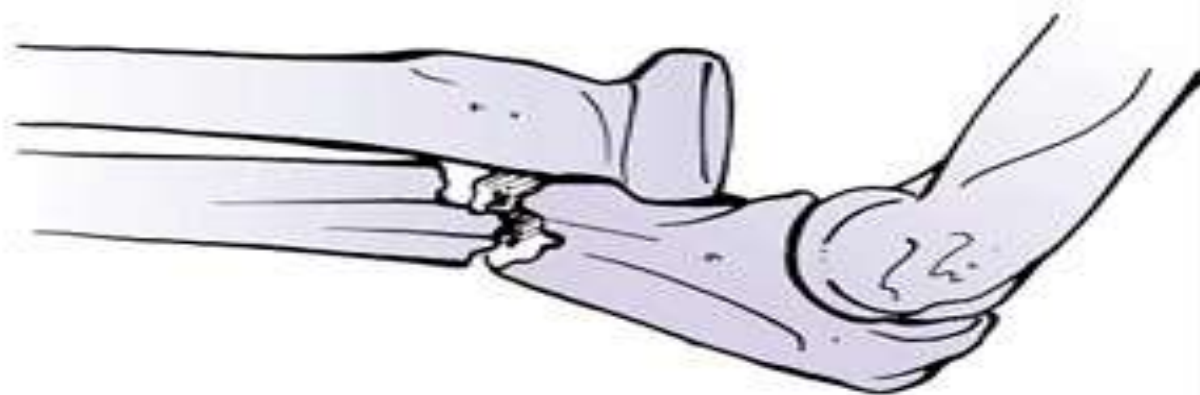
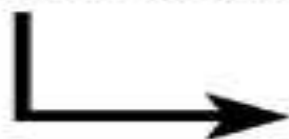
3).Alleviation of Deforming Forces:

elbow should be placed at approximately 110 to 120 degrees of flexion to alleviate the force of the biceps.

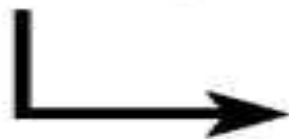
forearm is placed in a position of mid-supination to neutral rotation to alleviate the forces of the supinator muscle and the anconeus.

4).Immobilization.

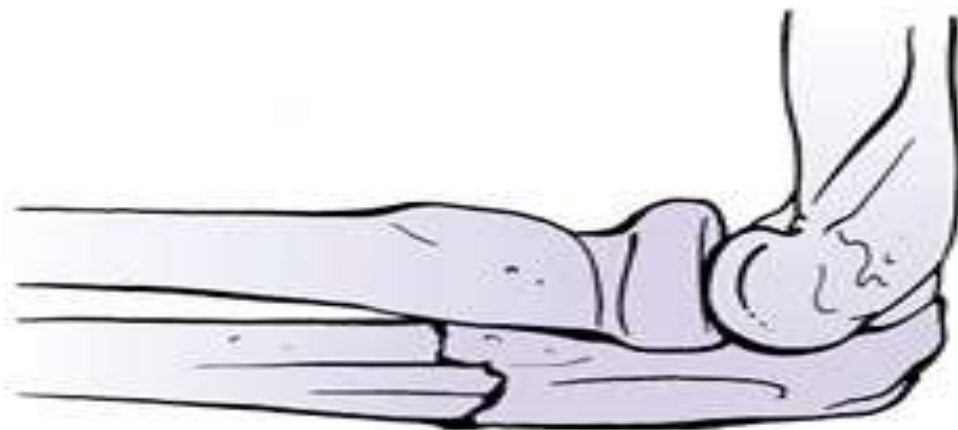
Angulation correction



Longitudinal traction
(Supination)

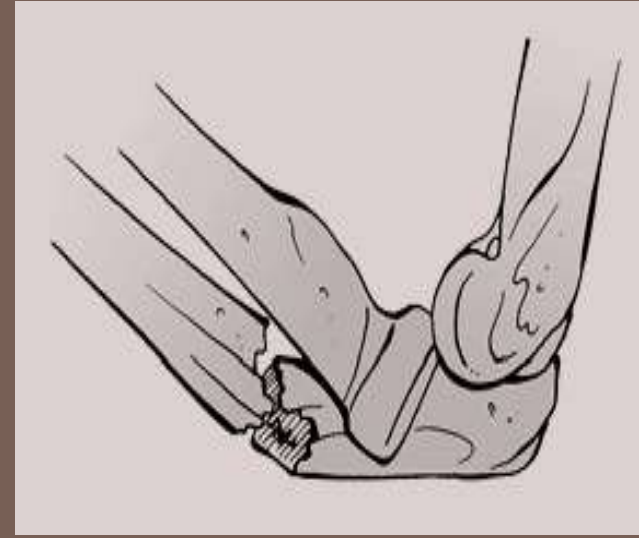


Flexion 90–100%



Immobilization/flexion
100–110° supination

TYPE II MONTEGGIA FRACTURE DISLOCATIONS



- ❖ More common in older patients (approximately 13 years) who have sustained significant trauma.
- ❖ accounting for 5% in most series of Monteggia lesions in children

CLINICAL FINDINGS

- ❖ The elbow region is swollen but exhibits posterior angulation of the proximal forearm and a marked prominence in the area.
- ❖ Posterolateral to the normal location of the radial head. The entire upper extremity should be examined because of the frequency of associated fractures.

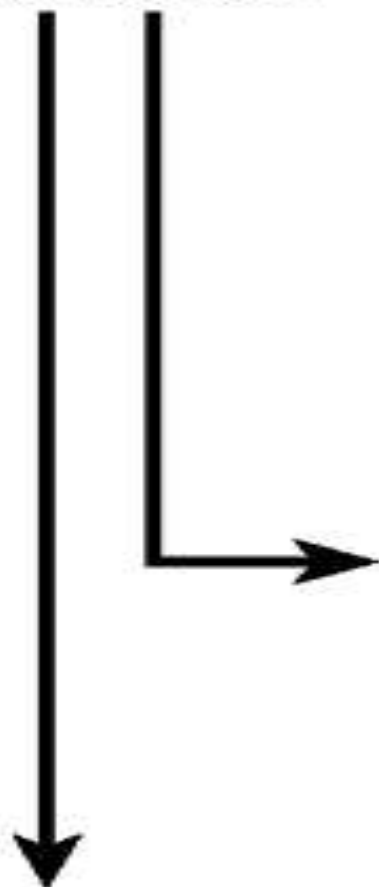
TREATMENT

NON OPERATIVE :

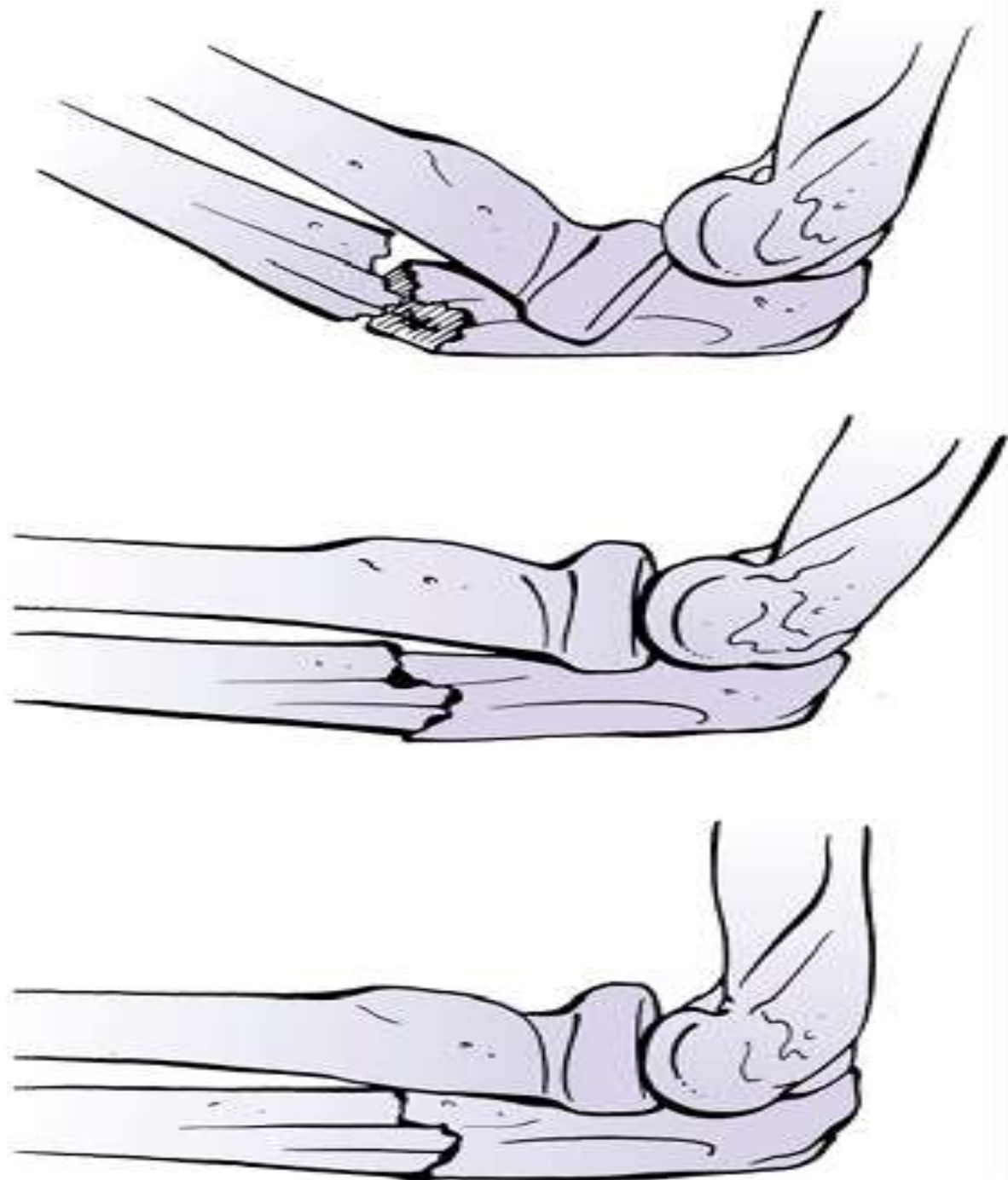
- ❖ The ulnar fracture is reduced by longitudinal traction in line with the long axis of the forearm while the elbow is held at 60 degrees of flexion.
- ❖ The radial head may reduce spontaneously or may require gentle, anteriorly directed pressure applied to its posterior aspect.

Type II

Traction in
flexion/pronation
of the forearm



Immobilization
Flexion 60°
Extension



TYPE III MONTEGGIA FRACTURE DISLOCATIONS

Clinical Findings

- ❖ Lateral swelling.
- ❖ Varus deformity of the elbow.
- ❖ Significant limitation of motion, especially supination



- ❖ Second in frequency to anterior type I Monteggia fracture dislocations(approx. 26% in most series)
- ❖ Injuries to the radial nerve, particularly the posterior interosseous branch, occur frequently with this lesion.
- ❖ Open reduction of the radial head often is necessary because of interposition of soft tissue between it and the ulna or capitellum.

RADIOGRAPHIC EVALUATION

- ❖ The radial head may be displaced laterally or anterolaterally.
 - ❖ The ulnar fracture often is in the metaphyseal region but it can occur more distally.
 - ❖ Radial angulations at the fracture site is common to all lesions,
- Regardless of the level. X-rays of the entire forearm should be obtained because of the association of distal radial and ulnar fractures with this elbow injury complex.

TREATMENT

NON OPERATIVE.

❖ Ulnar Reduction:

The elbow is held in extension with longitudinal traction. Valgus stress is placed on the ulna at the site of the fracture, producing clinical realignment.

❖ Radial Head:

May spontaneously reduce or need assistance with gentle pressure applied laterally

Ulnar length and alignment must be maintained to ensure a stable radial head.



MAINTENANCE OF REDUCTION

- ❖ Reduction is maintained by a long-arm cast with the elbow in flexion.
- ❖ The degree of flexion varies depending on the direction of the radial head dislocation.
- ❖ When the radius is in a straight lateral or anterolateral position, flexion to 110 to 120 degrees improves stability.
- ❖ If there is a posterolateral component to the dislocation, a position of only 70 to 80 degrees of flexion has been recommended.
- ❖ Forearm rotation usually is in supination, which tightens the interosseous membrane and further stabilizes the reduction.

Elbow extended



Abduction



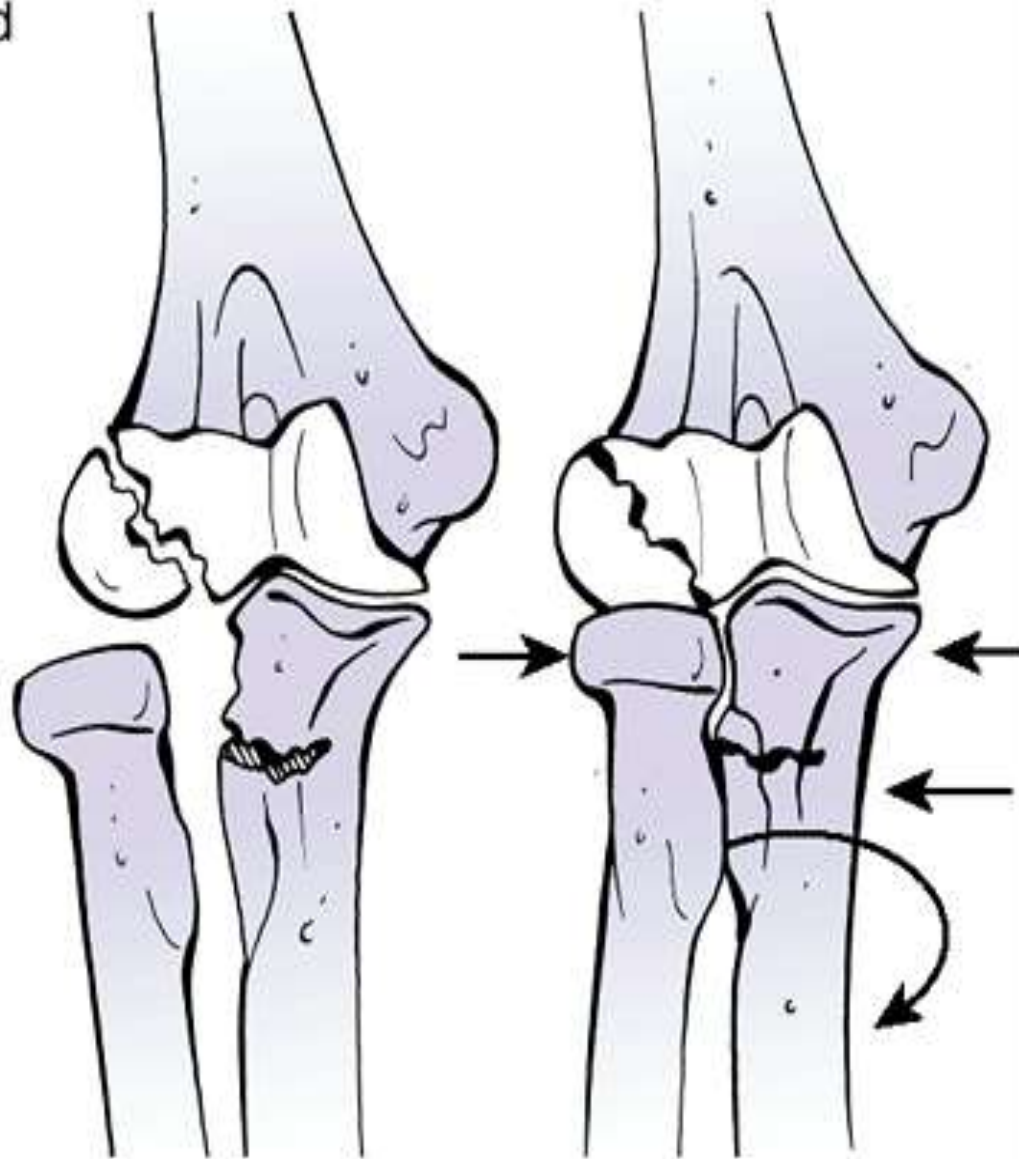
Pressure over
radial head



Supination

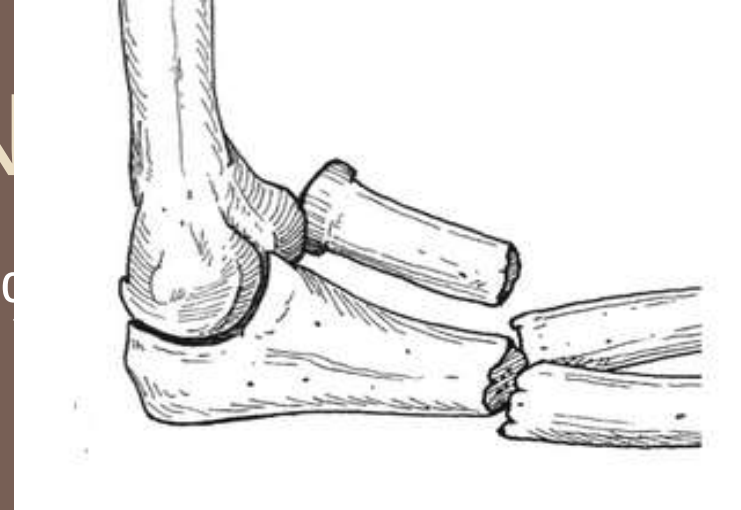


Immobilization
Flexion 90°/supination



TYPE IV LESION

Relatively rare in children's, approx. 1%



Clinical Findings:

- ❖ The appearance of the limb with a type IV lesion is similar to that of a type I lesion. More swelling and pain are present because of the magnitude of force required to create this complex injury.
- ❖ Particular attention should be given to the neurovascular status of the limb, anticipating the possible increased risk for a compartment syndrome.

TREATMENT

NON OPERATIVE:

- ❖ Closed reduction should be attempted initially, with the aim of transforming the type IV lesion to a type I lesion.
- ❖ Use of the image intensifier allows immediate confirmation of reduction, especially of the radial head.

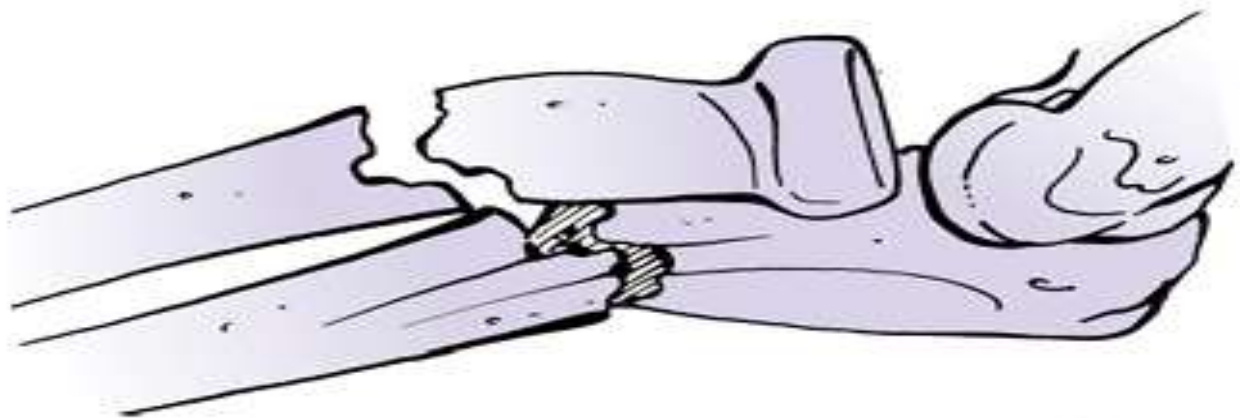
The elbow is immobilized in a long-arm cast for 4 weeks in 110 to 120 degrees of flexion with the forearm in neutral rotation.

A short-arm cast is used for an additional 4 weeks while early range of motion at the elbow and forearm is begun.



Type IV

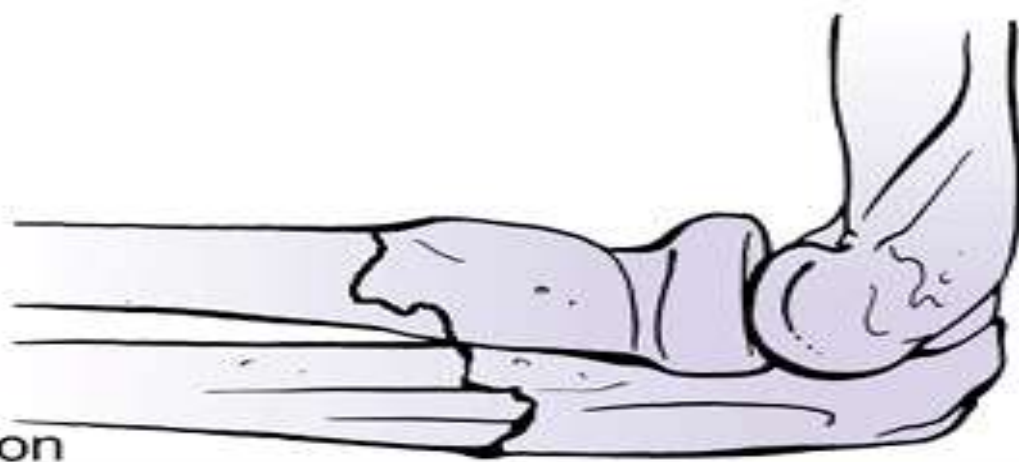
Radial angulation
correction



Traction
longitudinal/supination
transform in type I



Flexion 80–100°



Immobilization

Flexion 100--110°/supination

OPERATIVE TREATMENT

Indications

There are two indications for operative treatment of type I fracture dislocations

- 1). failure of ulnar reduction
- 2). failure of radial head reduction.

FAILURE OF ULNAR REDUCTION

- ❖ If the ulnar fracture cannot be reduced or held in satisfactory alignment by closed treatment, operative intervention is indicated.
- ❖ The ulnar fracture can be reduced but not maintained because of the obliquity of the fracture, internal fixation combined with open or closed reduction may be necessary.
- ❖ Intramedullary fixation, rather than fixation with a plate, is standard.
- ❖ Can be accomplished percutaneously, using image intensification and flexible nails or Kirschner wires.

FAILURE OF RADIAL HEAD REDUCTION

- ❖ More common in type III Monteggia lesions.
- ❖ Results from the interposition of material, including torn fragments of the ruptured orbicular ligament and capsule or an entrapped orbicular ligament pulled over the radial head.
- ❖ Obstruction in reduction of the radial head by radial nerve entrapment between the radial head and ulna has been described.

SURGICAL APPROACH

- -
 -
 -
1. Kochers Approach: *Incision* : begin skin incision over the lateral epicondyle & continue it distally and obliquely directly over lateral epicondyle to end at proximal ulna.
Interneural plane – Between Anconeus and ECU.
Safer as it affords protection to the PIN.

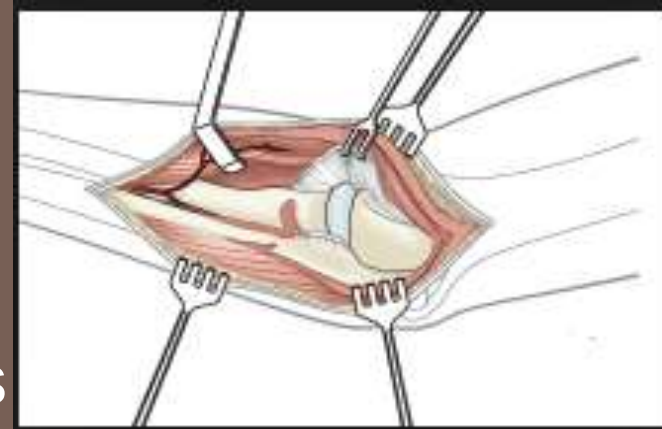
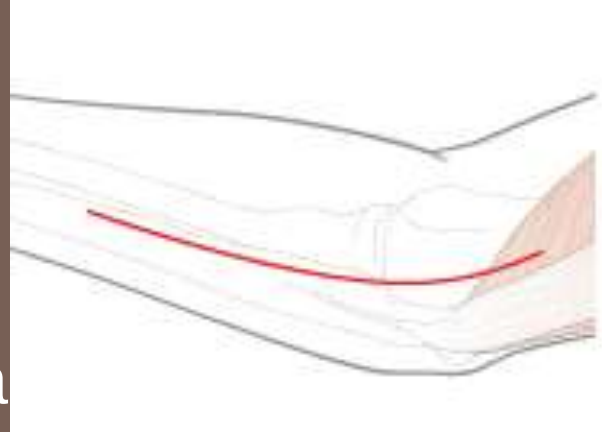


Boyd Approach:

Incision - lateral to the lateral condyle and extending it along the radial side of the ulna.

The incision is carried under the anconeus and extensor carpi ulnaris in an extraperiosteal manner, elevating the fibers of the supinator from the ulna.

This carries the approach down to the interosseous membrane, allowing exposure of the radiocapitellar joint, excellent visualization of the orbicular ligament, access to the proximal fourth of the entire radius, and approach to the ulnar fracture.



Radial Head:

If the reduction is unstable, repair or reconstruction of annular ligament should be done, combining it with the use of a transcapitellar Steinmann pin or transmetaphyseal pin from the radial neck to the ulnar proximal metaphysis.

Ulnar Fracture:

If the fracture seems to be unstable on the initial films or at the initial, internal fixation using an intramedullary pinning technique is done. This can be accomplished by using a single pin of sufficient size or multiple small pins, nesting them within the medullary canal to provide stability.



COMPLICATIONS

1. Neglected Monteggia Fracture.
2. Nerve Injuries.
3. Periarticular Ossification.
4. Compartment Syndrome.

1. Old Undetected Fracture Dislocations

Recognition of a dislocated radial head at the time of injury can prevent the difficult problem of persistent radial head dislocation.

the natural history of persistent dislocation is not benign and is associated with restricted motion, deformity, functional impairment (weakness, instability), pain, degenerative arthritis, and late neuropathy.

An undetected, Isolated radial head dislocations with no apparent lesion of the ulna associated with remote trauma have been mistaken for congenital radial head dislocations.

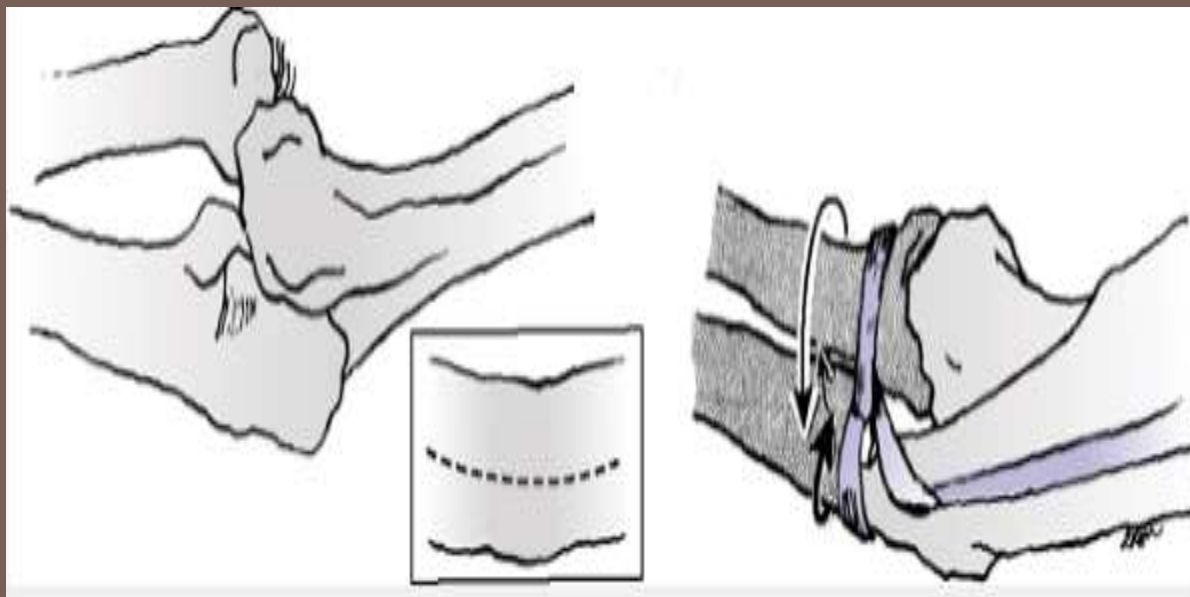
Kalamchi* reported pain, instability, and restricted motion, especially loss of pronation and supination. He also noted that children have a Valgus deformity and a prominence on the anterior aspect of the elbow.

*Kalamchi A. Monteggia fracture dislocation in children. J Bone Joint Surg [Am] 1986;68:615 - 619

ANNULAR LIGAMENT RECONSTRUCTION

Bell-Tawse used the central portion of the triceps tendon passed through a drill hole and around the radial neck to stabilize the reduction and immobilized the elbow in a long-arm cast in extension.

Bucknill and Lloyd-Roberts modified the Bell-Tawse procedure by using the lateral portion of the triceps tendon, with a transcapitellar pin for stability. The elbow was immobilized in flexion.



The central slip of the triceps is used to reconstruct an annular ligament.

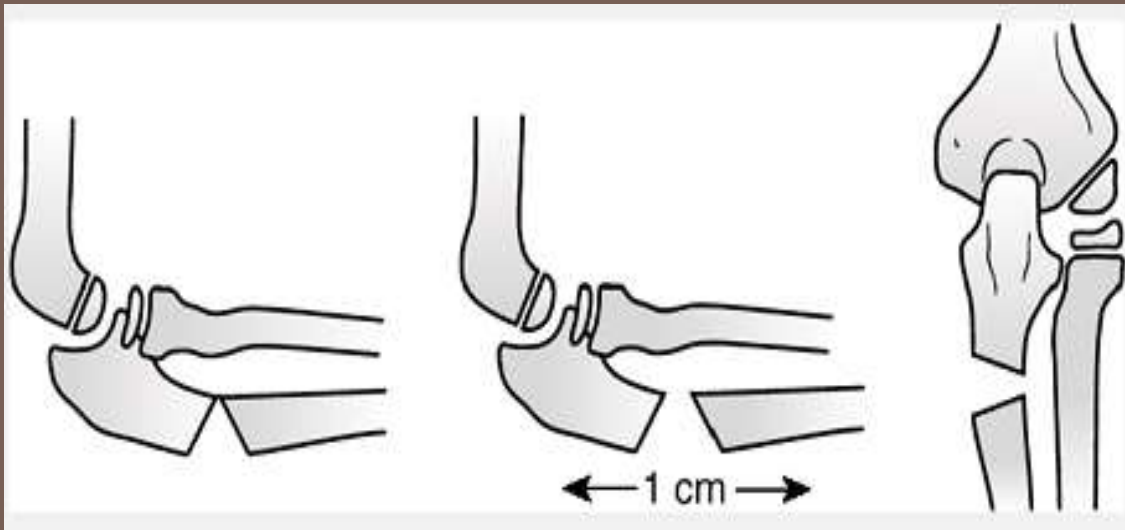
- ❖ Hurst and Dubrow used the central portion of the triceps tendon, but carried the dissection of the periosteum distally along the ulna to the level of the radial neck, which provided more stable fixation than stopping dissection at the olecranon as described by Bell-Tawse.
- ❖ They also used a periosteal tunnel rather than a drill hole for fixation of the tendinous strip to the ulna.
- ❖ Thompson and Lipscomb used a fascia lata graft passed through a hole drilled in the ulna.

OSTEOTOMY

Various types of osteotomies have been used to facilitate reduction of the radial head and prevent recurrent subluxation after annular ligament reconstruction.

- ❖ Kalamchi reported using a drill hole•ulnar osteotomy to obtain reduction of the radial head in two patients. Minimal periosteal stripping with this technique allowed the osteotomy to heal rapidly.
- ❖ Mehta used an osteotomy of the proximal ulna stabilized with bone graft.

- ❖ Freedman et al reported a delayed open reduction of a type I Monteggia lesion without annular ligament reconstruction but with ulnar osteotomy, radial shortening, and deepening of the radial notch of the ulna.
- ❖ Oner and Diepstraten suggested that ulnar osteotomy is not necessary in type I lesions (anterior dislocation), but in type III lesions (anterolateral dislocation) recurrent subluxation is likely without osteotomy.



- ❖ Left. Floating open osteotomy without fixation or bone graft.
- ❖ Center. Hirayama distraction osteotomy, grafted and fixed with a plate and screws.
- ❖ Mehta osteotomy is similar but is held with a bone graft only.
- ❖ Right. Valgus osteotomy for a type III lesion: floating osteotomy with bone graft. This osteotomy can be stabilized with an intramedullary pin

NERVE INJURIES

- ❖ The literature reflects a 10% to 20% incidence of **radial nerve** injury, making it the most common complication associated with Monteggia fractures .
- ❖ It is most commonly associated with types I and III injuries.
- ❖ The posterior interosseous nerve is most commonly injured because of its proximity to the radial head and its intimate relation to the arcade of Frohse.
- ❖ Nerve function usually returns by approximately 9 weeks after reduction.

Median and Ulnar nerve injury though uncommon but have been reported in some case series.

PERIARTICULAR OSSIFICATION

Two patterns of ossification after Monteggia fracture dislocations have been noted radiographically:

- ❖ Around the radial head
- ❖ Myositis ossificans.

❖ Ossification around the radial head and neck appears as a thin ridge of bone in a cap like distribution and may be accompanied by other areas resembling sesamoid bones.

❖ Ossification also may occur in the area of the annular ligament.

❖ **Elbow function generally is not affected by the formation of these lesions.**





Persistent dislocations of the radial head are frequently accompanied by a thin cap of bone and other areas resembling sesamoid bones.

❖ The other form of ossification is true Myositis ossificans, reported to occur in approximately 3% of elbow injuries and 7% of Monteggia lesions in adults and children .

❖ Myositis ossificans has a good prognosis in patients younger than 15 years of age, appearing at 3 to 4 weeks after injury and resolving in 6 to 8 months.

RECENT UPDATES

Indian Journal of Orthopaedics

Medknow Publications

Outcome of radial head preserving operations in missed Monteggia fracture in children

Parag Ga

Additional a

Abstract

Hirayama's osteotomy is inherently more stable than the simple transverse osteotomy and it should be combined with annular ligament reconstruction. Palmaris longus graft for ligament reconstruction provides more stability as compare to Bell Towse's procedure.

Background:

The dislocated radial head in missed Monteggia fracture loses its concave articular surface and displays hypertrophic changes and flattened humeral capitellum configuration, thereby limiting the range of motion. We evaluated the

Long-term evaluation of surgically treated anterior monteggia fractures in skeletally mature patients.

Guittou TG, Ring D, Kloen P.

Orthopaedic Hand and Upper Extremity Service, Harvard Medical School, Massachusetts General Hospital, Boston, MA 02114, USA.

Abstract

PURPOSE: The purpose of this retrospective study was to evaluate the functional and radiological long-term outcome of open reduction and internal fixation of skeletally mature patients with a Bado type 1 Monteggia fracture.

METHODS: We identified 11 consecutive skeletally mature patients who had surgical treatment of an anterior (Bado type 1) Monteggia fracture. Long-term evaluation at a median of 20 years after injury (range, 7-34 years) was compared with an early evaluation at a median of 6.12 months after injury (range, 4.33-9.6 months). The elbow, forearm, and hand were evaluated radiographically and functionally using the Mayo Elbow Performance Index, Broberg and Morrey, and DASH scores. The elbow was evaluated according to the Arm Shoulder and Hand scores.

THE RESULT OF OPEN REDUCTION AND INTERNAL FIXATION OF ANTERIOR MONTEGGIA FRACTURES ARE MAINTAINED OVER LONG FOLLOW UP.

RESULTS: Two patients had subsequent surgery to address a nonunion and 3 elbows had radiographic signs of arthrosis. The mean arc of elbow flexion increased from 110 degrees (range, 35 degrees to 140 degrees) at early follow-up to 120 degrees (range, 40 degrees to 150 degrees) at late follow-up. The mean arc of forearm rotation increased from 145 degrees (range, 90 degrees to 180 degrees) to 149 degrees (range, 90 degrees to 180 degrees). The mean Broberg and Morrey score increased from 89 points (range, 62-100 points) to 94 points (range, 76-100 points). The median DASH score was 7 points (range, 0-34 points) at long-term follow-up. There was no statistical difference between early and late range of motion or Broberg and Morrey score.

CONCLUSIONS: The results of open reduction and internal fixation of anterior Monteggia fractures in skeletally mature patients are maintained over long-term follow-up.

TYPE OF STUDY/LEVEL OF EVIDENCE: Therapeutic IV.



Treatment of neglected Monteggia's fracture by ulnar lengthening using the Ilizarov technique

(PMID:11148422)

[Abstract](#)

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Gicquel P, De Billy B, Karger C, Maximin MC, Clavert JM

Service de Chirurgie Infantile, Hôpital de Hautepierre, 1, avenue Molière, 67098 Strasbourg Cedex.

Revue de Chirurgie Orthopedique et Reparatrice de L'appareil Moteur [2000, 86(8):844-847]

Type: Journal Article

THIS METHOD ALLOWS REDUCTION WITHOUT ACCESSING THE RADIAL HEAD BY PROGRESSIVE ULNAR LENGTHNING AFTER PROXIMAL SUBPERIOSTEAL

Abstract

Highlight Terms ?

No biological terms identified

We present an original method for the treatment of neglected Monteggia fractures using the Ilizarov technique. This method allows reduction without accessing the radial head by progressive ulnar lengthening after proximal subperiosteal osteotomy of the ulnar bone. We used this method in a six and a half year old girl and achieved excellent radiographical and functional results with normal joint amplitudes. In our opinion, the quality of the outcome is related to the progressiveness of the bone lengthening enabled by this technique which allows restoration of the ulnar length, preservation of the axes of both forearm bones, and controlled reduction of the radial head.

Open reduction, ulnar osteotomy and external fixation for chronic anterior dislocation of the head of the radius

C. C. Hasler,
L. Von Laer,
A. K. Hell

*From the University
Children's Hospital,
Basel, Switzerland*

We reviewed 15 patients, nine girls and six boys, with chronic anterior dislocation of the radial head which was treated by ulnar osteotomy, external fixation and open reconstruction of the elbow joint but without repair of the annular ligament. Their mean age was 9.5 years (5 to 15) and the mean interval between the injury and reconstruction was 22 months (2 months to 7 years).

All radial heads remained reduced at a mean follow-up of 20 months (6 months to 5 years). Normal ranges of movement for flexion, extension, pronation and supination were

RECONSTRUCTION OF RADIOCAPITELLAR JOINT IS EASIER USING EXTERNAL FIXATION SINCE ACCURATE CORRECTION OF ULNA CAN BE DETERMINED EMPIRICALLY AND ACTIVE

were selected for treatment by this method.

The outcome of surgical reconstruction of long-standing dislocation of the radial head is uncertain. Further subluxation and dislocation may occur in more than 20% of patients.¹⁻⁸ Complications such as restriction of movement, nonunion of the osteotomies, avascular necrosis of the radial head, radio-ulnar synos-

the forearm, nerve

October 2002, 15 patients, nine girls and six boys, were treated by open reduction, ulnar osteotomy and external ulnar fixation (Table I). All the operations were performed or supervised by two of the authors (CCH/LVL).

The mean age of the patients at operation was 9.5 years (5 to 15). The right elbow was affected in seven and the left in eight patients.